

Courtesy of:



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The Glass Menagerie

Small towns across the United States are full of family run businesses, many in the third or fourth generation. In a small town not too far from here, there exists such a business. This business manufactures and sells various types of flint glass as dichromatic lenses used in reducing the focal differences between red and blue light known as chromatic aberration, as well as selling leaded glass to various medical supply houses.

The Owner, Vladimir Smudge started the company 50 years ago, shortly after entering the USA from Romania. Vlad, as his friends call him, has 4 Sons; Shad, Chad, Thad and Brad, all of which are active in the family business. Since the business manufactures 4 different types of flint glass, each of the Sons run one production line:

Son	Type of Glass	Index of Refraction
Shad	Arsenic Trisulfide Glass	2.04
Chad	Lanthanum Flint Glass	1.87
Thad	Extra-Dense Flint Glass EDF-3	1.72
Brad	Standard Flint Glass	1.6

Although Vlad loves his Sons, his heart has always truly belonged to his chihuahua, Brutus. Many times, Vlad would tell one of the boys to give up their seat at the table so Brutus could have it. Last Christmas, Vlad even gave Brutus the choicest piece of meat from the Christmas Turkey. Vlad routinely gives Brutus table treats such as thickened gravy and apple pieces. As a result, all of the boys hated that dog. In fact, they often joked about different ways they could terminate it.

Vlad attempted to run in the Memorial Day Marathon last year, but only managed to make it 8 miles where he promptly fell over from a heart attack. He was rushed to the hospital where he spent the next 3 weeks recovering. When he finally came home on Monday, June 23rd, he noticed his dog Brutus was missing. He searched the property frantically and finally found the partially decomposed body of the tiny dog in the shallow ditch behind the factory, with a large shard of glass projecting from its bloated side. Tucked under the collar was hand-printed note that simply said *"I win"*

SUSPECTS:

Shad Smudge: Shad is 37 years old and the oldest son of Vlad. He enjoys organic gardening, and focuses most of his attention on monosaccharide type fruits. In fact, he attended a seminar on organic gardening at University of Florida June 8th to the 14th. He cooks a vegan dinner for the family every Sunday and Tuesday. Shad uses polystyrene peanuts in a cardboard box to pack his optic lenses. Shad has type A blood

Chad Smudge: Chad is 32 years old. Chad has always been the athlete and was the High School star Quarterback, earning him a full scholarship at OSU which was revoked when he tested positive for steroid juicing, forcing him to accept a scholarship offer from an undisclosed University north of Ohio. The week of June 15th to the 21st he volunteered at a University of Michigan Pee Wee Football Camp for incoming college freshman. Although he no longer takes steroids, he takes about every OTC drug available from antacids to foot powders. Chad wraps the glass from his line in a low density polyethylene film, then in a polycarbonate case. He fixes the family a chicken dinner every Monday and Wednesday. Chad has type B blood

Thad Smudge: Thad is 28 years old. He is the outdoorsman of the group, He supplies the family with all of the venison, rabbit, and turkey they care to eat, and can field dress any kill faster than a professional butcher, but has become increasingly concerned over what effect the prolific use of fertilizers may be having on the game located on his hunting grounds, next to their factory. He was going to take the week of June 1st to June 7th off to scout some new Canadian hunting grounds for a trip next fall, but due to his father's heart attack, he delayed his trip for 4 days, and took the 5th to the 11th off instead. The glass from his manufacturing line is ground into convex optic lenses and installed in Poly Vinyl Chloride tube housings used for chromatic telescopes. He fixes the family a rabbit with thickened orange juice glaze for dinner every Thursday and Friday. Thad has type AB blood

Brad Smudge: Brad is the baby of the clan at 24 years old. He recently completed his degree in metallurgy, specializing in sculpting that required brazing small pieces of aluminum together with a special flux. Brad manages the most basic of the glass lines and ships sheets of his glass on pallets covered on top and bottom with Polymethylmethacrylate. As the youngest brother, he is the one that gets stuck attending all of the glass trade shows and symposiums. His most recent trip was June 19th through the 22nd in "The Glass City," Toledo, Ohio. He is responsible for Saturday night dinners, but usually stops at the local Chinese restaurant and brings home some egg rolls and General Tsao's Chicken. Brad has type O blood.

EVIDENCE:

Upon further examination, several key pieces of evidence were found on, next to, and under the dead dog and summarized as:

- ❑ Evidence 1 – Trace White Powder found in the soil around the corpse
- ❑ Evidence 2 – Trace White Powder found in the mouth and digestion tract of the “Victim”
- ❑ Evidence 3 – White Powder found sprinkled liberally over the “Victim”
- ❑ Evidence 4 – Trace White Powder found on the front seat of Shad’s car
- ❑ Evidence 5 – Polymer found around the “Victim’s” neck
- ❑ Evidence 6 – Polymer found 30 feet from the ‘Victim”
- ❑ Evidence 7 – Polymer found on the driver’s floor of Shad’s car
- ❑ Evidence 8 – Polymer found on the driver’s floor of Chad’s car
- ❑ Evidence 9 – Polymer found on the driver’s floor of Thad’s truck
- ❑ Evidence 10 – Polymer found in the trunk of Brad’s car
- ❑ Evidence 11 - Triangular shaped fiber found around the “Victim’s” neck
- ❑ Evidence 12 – Ink sample taken from Shad’s pen
- ❑ Evidence 13 – Ink sample taken from Chad’s pen
- ❑ Evidence 14 – Ink sample taken from Thad’s pen
- ❑ Evidence 15 – Ink sample taken from Brad’s pen
- ❑ Evidence 16 – Ink sample taken from the note found on the “Victim”
- ❑ Evidence 17 - Partial Fingerprint found on the shard of glass used to stab the “Victim”
- ❑ Evidence 18 - Glass analysis based on refractive results
- ❑ Evidence 19 - Entomological analysis of the corpse
- ❑ Evidence 20 - Analysis of blood found on the grasped end of the shard of glass

Qualitative Analysis:

PART 3.a- Chemical Analysis (10 Points Each – 40 possible)

Using the Bunsen Burners and Chemical Indicators, Identify the following Powders:

- Evidence 1 _____
- Evidence 2 _____
- Evidence 3 _____
- Evidence 4 _____

PART 3.b- Polymer / Fiber Analysis (5 Points Each – 35 Points Possible)

Using the communal density liquids located at the front of the room, identify the following Polymers:

- Evidence 5 _____
- Evidence 6 _____
- Evidence 7 _____
- Evidence 8 _____
- Evidence 9 _____
- Evidence 10 _____

Identify the following Fiber:

- Evidence 11 _____

PART 3.c- Chromatography (30 Points Possible)

Create a solution of 50% water and 50% Alcohol (70%) to use as an eluting solution, making sure that the labels stay intact. Make sure that each test is given the same amount of time. At the end of test, mark the leading edge of the eluting solution with your pen to document your findings after evaporation, then calculate the Rf values and enter them below. Tape your completed chromatograms here:

EVIDENCE 12 Shad's Pen	EVIDENCE 13 Chad's Pen	EVIDENCE 14 Thad's Pen	EVIDENCE 15 Brad's pen	EVIDENCE 16 (NOTE)
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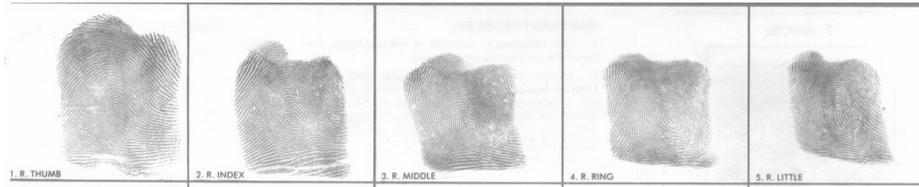
Calculate the Rf values of each:

Which pen was used to write the note? Support this determination using the findings above

PHYSICAL EVIDENCE
PART 3.d.i – Fingerprints (10 Points)



Shads Prints



Chads Prints



Thads Prints



Brads Prints



EVIDENCE 17

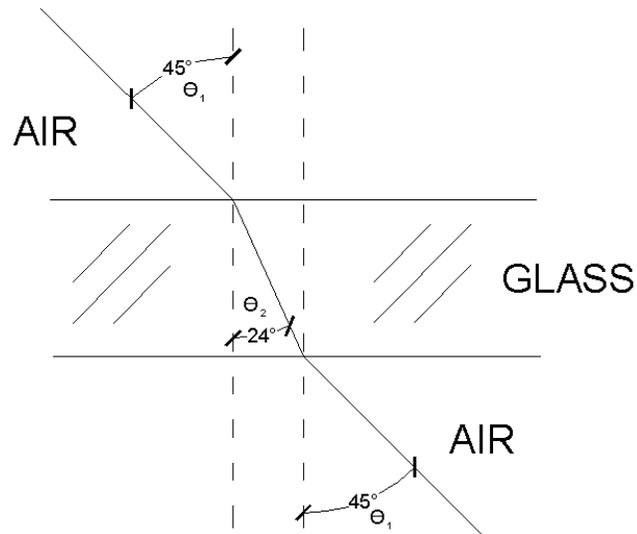
Partial Print recovered from glass shard

Circle the matching print

Which Suspect matches the partial print? _____

PART 3.d.iii – Glass Refraction (10 Points)

Evidence 18 was the shard of glass removed from the Victim. It was carefully removed, cleaned, and analyzed. The refractive tendencies of the glass are listed below:

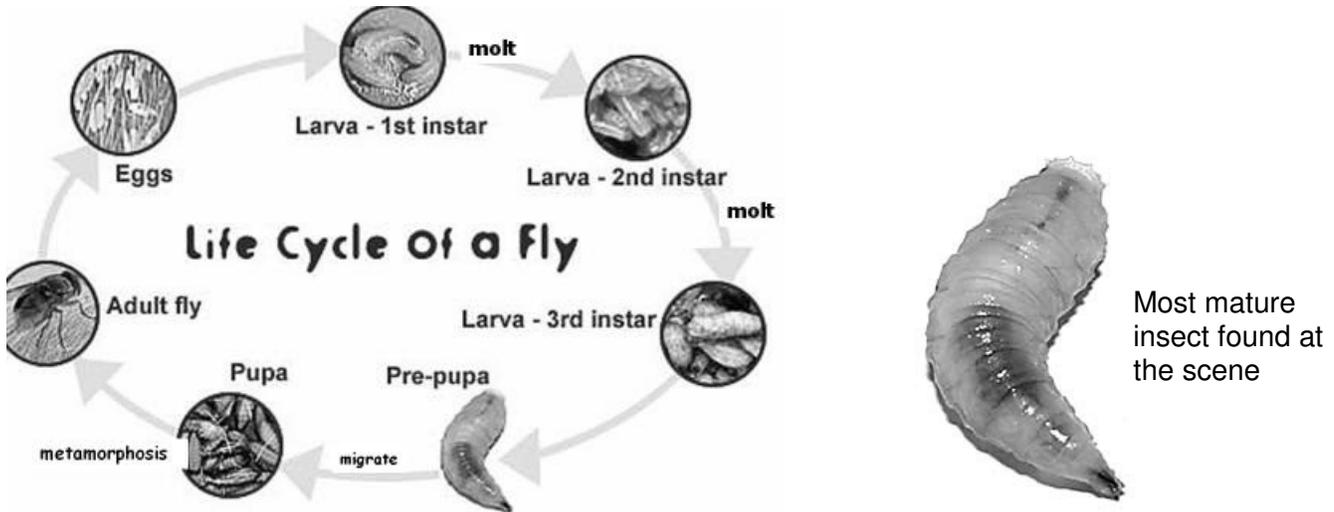


Using the above data, calculate the Index of Refraction below. Show the formula used as well as a legend that defines the variables of your equations

Comparing your results to the data on page 1 of this Scenario, which type of glass was the shard made from?

PART 3.d.iv – Entomology (10 Points)

Evidence 19 was insects collected from the corpse. The local Entomologist has identified these as various stages of the same insect – the Blow Fly. After careful examination, it appears that every stage of the lifecycle was found at the scene except the pupa stage. Even the surrounding area was examined. It was as if none of the eggs had reached that maturity yet. The adult flies that were found were examined and found to be in excess of 4 months old and the source of the non-mobile stages found



A quick check with the local weatherman provided the average temperature for the month of June as 70 degrees Fahrenheit. Using the most mature site generated life stage of the flies found at the scene, and converting this temperature to Celsius using the formula “(F-32) x 5 / 9 = C,” then referencing the chart below should provide a reasonably accurate time of death.

Temp(°C)	Egg Larva (hours)	1st Instar (hours)	2nd Instar (hours)	3rd Instar (hours)	Pre-Pupa (hours)	Pupa (hours)	Total Time (Days)
16	41	53	42	98	148	393	32
21	21	31	26	50	118	240	20
27	18	20	12	40	90	168	14

Calculations:

Based on the above information, the date of death was most likely how many days prior to the date of Discovery?

PART 3.d.viii – Serology (10 Points)

Using the Serology plate provided, carefully approach the unnamed suspect in the corner of the room and collect 2 drops of his blood. Now take it to the Nurse and ask for a drop of A and B testing solution. Mix thoroughly with toothpick provided. An agglutination reaction may take up to 3 minutes.

A positive agglutination reaction would indicate the presence of those antigens and a lack of those antibodies. Be advised that as in a real lab setting, the reaction to type B antigens (if any) is much more subdued than the type A reaction, so watch closely.

A positive reaction to both solutions could indicate either an AB blood type or a mixture of blood from at least two individuals with A and B blood. Since type O blood provides a negative reaction to both solutions, the remote possibility always exists that that it may also be mixed in with either of the above scenarios. Further analysis under an electron microscope can determine if the sample is from more than one person, but in this test, it can only prove exclusionary to types A, B, or AB with negative results.

Based on this level of testing, list the possible suspect or groups of suspects if sample was mixed

PART 3.e – Analysis of the Crime (60 Points Possible)

On the Calendar below, note the following:

- Date of Corpse Discovery
- Date of Death, based on Entomological Data
- Potential Alibi dates of each of the sons,

June 2008						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Now, tie it all together with a written essay not to exceed this page, front only.